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FINAL TECHNICAL REPORT

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"Investigations of the Low Frequency Radio Emissions
from Outer-Planet Magnetospheres"

DEPARTMENT OF ASTRONOMY
UNIVERSITY OF FLORIDA
GAINESVILLE, FLORIDA

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1. Completion of S Burst Catalog. A 200-page book entitled "A Catalog of High Resolution Jovian Decametric Radio Noise Burst Spectra", by R.S. Flagg, W.B. Greenman, F. Reyes, and T.D. Carr, has been completed and widely distributed. This profusely illustrated publication summarizes many years of research on Jovian decametric S bursts at the University of Florida Radio Observatory, presenting and analyzing high-resolution high-sensitivity dynamic spectra from 22 of the most interesting Jovian noise storms occurring between 1972 and 1989. Various types of auxiliary plots and considerable textual material are also included. The book will no doubt be a major source of information on S burst phenomenology for many years to come.

2. Jovian Decametric Beam Structure and Source Location Determination. From Voyager 1 and 2 recordings of Jovian decametric activity, Koiti Maeda and I have obtained new information on the locations of the Io-related sources A and C and on the shapes of their emission beams. In two instances we were able to identify the same dynamic spectral arc event in the recorded data of the two spacecraft, providing an unprecedented opportunity to observe the same emission beams over a wide range of frequencies simultaneously from widely different directions. Our direct measurements provide confirmation that the emission beams are in the form of thin, quasi-conical sheets, the cone opening angle decreasing with increasing frequency. They also confirm the fact that both the Io-A and Io-C sources were located near the northern foot of the magnetic flux tube connected with Io, and that the emission from both sources was in the X mode. The paper containing these results has been submitted for publication in the Journal of Geophysical Research; it is entitled "Measurement of Jovian Decametric Io-Related Source Location and Beam Shape", by K. Maeda and T.D. Carr.

3. Analysis of Voyager PRA Data from Neptune. Liyun Wang, Francisco Reyes, and I have begun a program of investigation based on the Voyager recordings of radio emission from Neptune. We now have a Sun Sparcstation computer, which is dedicated to this work. All our data analysis will be based on original 6-sec average recordings which we have extensively cleaned. Subsequent low-pass, high-pass, and band-pass data filtering is performed to provide separate data sets specifically for the investigation of the Neptunian smooth component, the sharp-pulse component, and components of intermediate burst width, respectively. We have achieved some initial success in modeling the smooth component source location and beam shape at 40 kHz, assuming an OTD model of Neptune's magnetic field. However, since any OTD field model is presumably quite inaccurate in the 40 kHz radio source region (and would be much more inaccurate at the higher frequency source regions) because of the predominance of higher multipole components, we are investigating the feasibility of including the non-dipolar component of the magnetic field as one of the adjustable parameters in fitting a modeled intensity vs time curve to the corresponding observed one.

4. Beam and Source Location Modeling of Jupiter's Hectometric Radiation. We have developed a versatile three-dimensional ray tracing program for plotting hectometric emission ray paths through the Io plasma torus, and for other purposes. We have compared our early hectometric beam models with those which have subsequently been published, and have tentatively reached the conclusion that none so far are satisfactory. Although we have temporarily postponed work on this project because of the press of other research, we will return to it.

5. Other Activities. For some time we have been engaged in a search for a suitable site for the northern terminus of a 100-mile-baseline VLBI system for relative position measurements of Jovian decametric sources. As a result of the efforts of astronomy faculty at Valdosta State College we were offered a site at the Adel, Georgia airport, which we gladly accepted. A joint agreement between airport authorities, Valdosta State College, and the University of Florida was reached for the use of the land. More recently, however, the legal department at Valdosta State College reversed their earlier approval because of their fear of liability in case of accident. We therefore have located a new site, on Florida state land (for which there are no legal complications), and we expect to complete the installation within the next two months.

A search of tape recordings for SED (Saturn Electrostatic Discharge) events, using a PC computer, was begun but has been temporarily suspended because the method is too slow. These recordings were made by Francisco Reyes of our group about 4 years ago, utilizing the 45 MHz radio telescope at the Maipú Radio Astronomy Observatory in Chile. We will resume the tape search with the aid of our new Sun Sparcstation computer, which will provide greatly increased speed and memory capacity.

Reyes and I are conducting an investigation of the sub-pulse structure of Jovian decametric S bursts, employing a time resolution about two orders of magnitude higher than has previously been achieved in the best dynamic spectrograms.

The program of monitoring Jupiter's decametric radiation at the University of Florida Radio Observatory, begun in 1957, continued during the reporting period.

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INVENTION DISCLOSURE STATEMENT

NASA/GSFC Grant No. NAG 5-773,
"Investigations of the Low Frequency Radio Emissions
from Outer-Planet Magnetospheres".

No inventions have been made in the performance
of research covered by this grant.

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